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May 4, 2001

Donna Wieting
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Dear Ms Wieting:

Thank you for your letter of 6 March 2001 and the opportunity to comment on the proposed rulemaking for the US Navy SURTASS LFA sonar system.

I am concerned that the system constitutes a substantial risk to marine life, a risk that is acknowledged neither in the proposed rule nor in the US Navy's FEIS. Both documents use the scientific method incorrectly to conclude that the system will have a negligible impact on marine mammals. There are many problems with the documents. Most of the substantive criticisms of the DEIS (for instance many of those by commentators O-054, O-043, O-039, O-020, O-021, O-042, O-028, I-425, I-501, O-047 in the FEIS) have not been addressed logically or satisfactorily in the FEIS. My concerns include:

180dB criterion

The 180dB (re 1 μ Pa) criterion for harm to marine mammals used in the FEIS is not accepted by the vast majority of competent non US-Navy supported scientists. The US-Navy has provided large amounts of money to a segment of the marine mammal research community, a segment that has largely acquiesced in the changing of the criterion from 120dB.

The adoption of the 180dB criterion has no valid scientific basis (see my comments on LFA FEIS, O-021, also O-020, O-047). Instead a considerable, and growing, body of knowledge shows that underwater sound may severely affect marine life at much lower levels. This includes the experiments on migrating grey whales (both with LFA and other playbacks), observations of beluga whales and sperm whales reacting strongly to distant noise sources (see Richardson et al.,

1995), as well as the strandings of beaked whales in Greece and the Bahamas. In neither of these stranding events is it reasonable that all, or even many, of the animals involved received levels of greater than 180dB, yet they died. In the second case there is some evidence that this was a population-level phenomenon (see comments by K.C. Balcomb to J. Johnson of U.S. Navy).

In deriving their 180dB criterion, the Navy argues that Permanent Threshold Shift is the most serious consequence of underwater noise to marine mammals. The LFA FEIS does not specifically consider the possibility of non-auditory effects of the noise on marine mammals. Other mechanisms may be highly dangerous to whales, or other marine life. These include the resonance and rupture of internal organs and psychological effects causing stranding or other adverse behavior (such as too rapid ascents from depth). These could occur at lower levels than 180dB, and the evidence from the Greece and Bahamas strandings strongly indicates that they do.

Therefore, scientific evidence suggests that, despite uncertainty, a level of about 120dB is reasonable in considering when underwater noise may have a serious impact on marine mammals. This would extend several hundred kilometers from the LFA source (see my comments on LFA FEIS, O-021), and include areas of hundreds of thousands, or maybe millions, of square kilometers. This is not "relatively small".

"Independent scientists"

NMFS's opinion that scientists who receive large sums from the US Navy are "independent" is not tenable. These scientists are heavily dependent on the Navy; their research and perspectives should not be seen in that light.

LFA Scientific Research Program

The LFA scientific research program (SRP) has little to tell us about the potential effects of the system. The system was not used at the appropriate level and two of the projects were poorly conceived (see O-021) and carried out (see O-054). The projects lasted only a few weeks, did not examine what I and others consider to be the most likely species to be affected by LFA: the sperm and beaked whales. (Contrary to a statement in the proposed rulemaking, I, together with other scientists made this point at the pre LFA-SRP meeting in Boston.) Therefore the LFA-SRP has very little to tell us about the potential effects of the LFA system on marine life.

Mass strandings

There is a much better source of information on the potential impact of the system: mass strandings of beaked whales. Mass strandings in Greece and the Bahamas have been linked to military activities in about as close a way as is possible in the marine environment, and there are also indications for other areas from an earlier report of Simmonds and Lopez-Jurado (1991). The Navy's attempts to remove this linkage are very weak. The FEIS notes that the papers by Frantzis (1998) and Simmonds and Lopez-Jurado (1991) were post-hoc and correlative. This is correct, but they then go on to state that correlative studies cannot "provide evidence for causation". This is wrong, correlation does not prove causation, but it can provide evidence for

it. Correlation is better evidence for causation than experimental studies with poor controls and in which neither the treatments, nor the measured responses, are those of interest (such as those of the LFA-SRP). The Navy quote SACLANTEN (1998) looking for strandings around 11 other naval exercises in the Mediterranean, and finding none. However, as naval activities are undoubtedly more common than mass strandings, this is not a very good analytical strategy. Instead, it is better to examine cases of the rarer events, the strandings. Such an approach is pursued for strandings of beaked whales in data reported in Anon (2000).

To provide a firmer basis for the connection between mass strandings of beaked whales and military activities, I have made the following analysis of these data. The International Whaling Commission's Standing Working Group on Environmental Concerns reported that 8/49 beaked whale strandings, and 6/6 multiple species beaked whale strandings, occurring with "military activities" (Anon 2000). We do not know the rate of occurrence of "military activities", but, by assuming rates, it is possible to calculate the probability of these numbers of coincidences (or more) between strandings and military activities, under the null hypothesis that they are unrelated. The results are summarized in Table 1 (below). The numbers in Table 1 show that it is very unlikely that the strandings of beaked whales were unrelated to military activities, unless military activity is very common. In fact, for the probability that 8/49 (or more) beaked whale strandings occurred with military activities to be greater than $P=0.05$ (the usually accepted level for rejection of a null hypothesis), military activity would have had to occur more than 8.4% of the time, and for the probability that 6/6 multiple beaked whale strandings occurred with military activities to be greater than $P=0.05$, military activity would have had to occur more than 60.7% of the time. The actual rate of military activities in any area is probably nearer 0.1%. Thus the numbers of strandings of beaked whales with military activities is extremely unlikely to be a coincidence. Military activities are strongly implicated in these events.

The Navy (FEIS 3.2-46-47) dismisses such concerns by stating that the LFA uses different frequencies from those present during the Greek and Bahamas strandings. Although noise is almost certainly implicated, we do not know the manner in which the military activities caused the strandings. Thus there is no basis for the Navy's view that a change in frequency makes the LFA system safe when the others are not. It is also important to note that in the case of the Greek stranding, the frequencies used by the vessels did overlap those used by LFA (FEIS 3.2-45).

How LFA might cause important population-level effects

I will end my comments by presenting a scenario, a realistic scenario, by which LFA could cause serious population-level effects for beaked whales. We know little about the population biology of beaked whales, but one population has been studied, the northern bottlenose whales (*Hyperoodon ampullatus*) off Nova Scotia, and we can use this as a model. This population seems genetically distinct from animals in the nearest known other center of population of the species (Dalebout et al. 2001). About 34% of the population can be found, at any time, within an ocean area about 25km across (Gowans et al. 2000; Hooker et al. in press). The low frequency sonar used off Greece seems to have caused strandings in beaked whales within a radius of at least 25km from the source (see letter from K.C. Balcomb to J. Johnson

published on MARMAM), and so it is possible, and perhaps probable, that approximately 1/3 of the population of northern bottlenose whales could be killed by one brief usage of such a sonar in the vicinity of the beaked whales' concentration. The Nova Scotian bottlenose whales are not protected by the US Navy's "Offshore Biologically Important Area #1", although it is listed as intending to protect them (Table 2-3 of FEIS), as it only extends to the 200m isobath, and the whales are found almost exclusively in deeper waters (Hooker et al. 1999). We know almost nothing about the population biology of the other beaked whale populations, but it is a reasonable hypothesis that they are small, quite discreet geographically and sometimes concentrated, like those of the northern bottlenose whales. If so, they would be extremely vulnerable to the LFA system. This is strongly indicated by the Bahamas stranding ("it is probable that all Cuvier's beaked whales in the region when the naval exercise commenced were killed by the sonar" letter from K.C. Balcomb to J. Johnson published on MARMAM).

In conclusion, given what we know, LFA poses a substantial threat to marine mammals, perhaps especially the sperm and beaked whales, over wide geographic areas, and its operation should not be permitted.

Yours sincerely,



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Table 1. Probability of 8/49 beaked whale strandings, or 6/6 multiple species beaked whale strandings, occurring with "military activities", for different rates of military activities assuming military activities and strandings are independent (calculated using binomial distribution).

	Rate of "military activities":		
	10%	1%	0.1%
Phenomenon:	<i>Probability of occurrence (or worse):</i>		
8/49 beaked whale strandings with "military activities"	0.1119	0.0000	0.0000
6/6 multiple species beaked whale strandings with "military activities"	0.0000	0.0000	0.0000

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